EQUIPMENT FOR CONTINUOUS, HORIZONTAL CASTING OF METAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns equipment for continuous, horizontal casting of metal, in particular aluminum ~~aluminium, including~~. The equipment includes an insulated reservoir or pool, which is designed to contain liquid metal, and a ~~mould~~ mold, which can be removed from the pool, with an insulating plate with holes ~~which~~ that communicate with the ~~mould~~ mold. The ~~mould~~ mold includes a preferably circular cavity with wall material of permeable material, for example graphite, for the supply of oil and at least one tubular die arranged along the circumference of the cavity for the direct supply of coolant.

2. Description of Related Art

As stated above, directly cooled horizontal casting equipment for continuous casting of metal in which oil is supplied through the cavity wall through an annulus or a permeable wall element in order to form a lubricant film between the ~~mould~~ mold wall and the metal is already known.

Although this type of casting equipment functions reasonably well, the quality of the cast product is, however, much poorer than that of equivalent vertical casting equipment in which, in addition to oil, gas is also supplied through the cavity wall.

One of the disadvantages of vertical casting equipment is that it comprises a large number of ~~moulds~~ mold. This makes it expensive to produce.

Moreover, the vertical equipment is only designed to cast specific lengths in a semi-continuous process. This also makes it expensive to operate.

Casting with horizontal casting equipment involves the use of only a few ~~moulds~~ molds and the casting takes place continuously. Suitable lengths of the cast product are cut off during the casting operation. The continuous, horizontal casting equipment is thus both cheap to produce and cheap to operate.

SUMMARY OF THE INVENTION

One aim of the present invention was to produce horizontal equipment for continuous casting of metal, in particular aluminum ~~aluminium~~, with which the quality of the cast product is as good as the quality of the equivalent cast product with vertical casting equipment.

The equipment in accordance with the present invention is ~~characterised~~ characterized in that gas in addition to oil is supplied through the permeable wall material and that annuli are arranged between the permeable wall material and the ~~mould~~ mold housing to distribute the gas/oil to the wall material and that the annuli are divided into sectors using plugs and are supplied with oil/gas via separate supply channels for each sector, whereby the supply of oil/gas may be differentiated around the circumference of the ~~mould~~ mold cavity.

~~Claims 2-5 define the advantageous features of the present invention.~~

The present invention will be described in the following in further detail by way of examples and with reference to the attached drawings, ~~where~~ in which: Fig. 1 shows, in part, in an ~~elevation~~ elevational view, ~~the~~ casting equipment for continuous horizontal casting of long objects, for example aluminum ~~aluminium~~ billets~~.~~ ; and

Fig. ~~2 shows, in large scale,~~ Fig. 2a is an enlarged view of the ~~mould~~ mold shown in Fig. 1, taken in a longitudinal section along line A-A, and Fig. 2b is a cross sectional view of the mold shown in Fig. 1 ~~shown in Fig. 1, a) in cross-section, and b) in a Fig. 2b shows the mold longitudinal section.~~

DETAILED DESCRIPTION OF THE INVENTION

As Fig. 1 shows, the casting equipment 1 constructed in accordance with the present invention. The casting equipment comprises an insulated metal reservoir or pool 2 and a ~~mould~~ mold 3. The pool 2 is provided with a lateral opening 4 to the ~~mould~~ mold 3, where a connecting ring 5 formed of thermally insulating material forms the transition between the pool and the ~~mould~~ mold 3. On its side, the ~~mould~~ mold is releasably attached to a holding device 6. Via a hinge link 7, it is possible to swing the holding device and thus the ~~mould~~ mold 3 from a position in which ~~it~~ the holding device is in contact with the connecting ring 5 to a swung-out position which makes it possible to remove (replace) or repair the ~~mould~~ mold.

The ~~mould~~ mold itself, which is shown in further detail in ~~Fig. 2~~ Figs. 2a and 2b, comprises a two-part annular housing, of which a first main housing part 8 is provided with drilled holes ~~10,11~~ 10, 11 for the supply of oil or gas to interior, permeable cavity rings ~~12,13,~~ 12, 13, while a second housing part 9 is provided with an annular recess which forms a water cooling channel 14. The two housing parts 8 and 9 are held together by means of a number of screws 15. When ~~they~~ the housing parts are screwed together, as shown in ~~the figure~~ Fig. 2(a), a diagonal gap 16 is formed between the two parts so that, during the casting operation, water flows from the channel 14 and through the gap 16 along the entire periphery of the cast product just outside the outlet of the cavity 17.

As mentioned, permeable rings 12, 13, which are physically separated from each other by a gasket, sealing material 18 or ~~similar~~ the like, are included. These rings form the wall in the cavity 17.

An important feature of the present invention is that the annuli 20 (see Fig. ~~2, b)~~ 2b formed between the ~~mould~~ mold housing 8 and the rings 12,13 are provided with plugs 21 (only ~~2~~ two are shown in the drawing) so that the annuli 20 are broken up into two or more sectors as required. In this way, the supply of both gas and oil can be differentiated along the circumference of the cavity. Such differentiation, in particular of the gas supply, is important in order to be able to achieve a good casting result.

Supply of gas to the ~~mould~~ mold cavity of horizontal casting equipment is not previously known. To enable drainage of excess gas, and thereby avoid inclusion of gas in the cast metal product ~~under~~ during the casting process, a bore 29 is provided through the ~~mould~~ mold wall (the ring 12). The gas is led to an annulus outside of the ring 12 and further through a bore in the housing 8 (not further shown) to the atmosphere or a suitable gas collecting tank or the like for the gas.

At the inlet of the cavity 17, there is a plate 19 formed of thermally insulating material ("hot-top") which is held in place ~~using~~ by a retaining ring 22 via a screw connection 23.

As the wall of the cavity 17, ~~i.e.~~ the rings 12, 13~~, forms~~ form the primary cooling area during the casting operation, the area of the wall surface will represent one of the factors which determine the cooling of the metal.

The insulating plate 19 may, depending on the type of alloy and the primary cooling required, extend somewhat along the ring 12 (at 24)~~, somewhat~~. Reference

numeral 24 indicates a portion of the insulating plate that extends over a portion of the ring 12.

As the plate can be easily detached, it will be easy to replace the plate and thus cast different types of alloy in the same ~~mould~~ mold.

Otherwise, the casting equipment in accordance with the present invention works as ~~follows:~~ will be described below.

Liquid metal, for example ~~aluminium~~ aluminum, is poured into the pool 2 from a casting furnace or ~~similar~~ the like (not shown). The metal flows through the opening 4 and the holes 25, 26 in the plate 19 and then into the cavity 17.

At the beginning of the casting operation, the outlet 27 in the ~~mould~~ mold 3 is closed using a mobile casting shoe (not shown). As soon as the metal has filled the cavity 17, the shoe begins to move, while water is supplied through the gap 16 and gas and oil are supplied through the ring 12, 13.

As the casting shoe moves and the cavity is refilled with metal via the pool, a long casting piece is formed. The shoe is removed as soon as the casting piece has reached a certain length. Since the casting process is continuous, the casting piece may actually be of any length. However, it is expedient for the casting piece to be cut (not shown) into suitable lengths for extrusion or other purposes.

As mentioned above, the casting equipment is designed ~~for~~ to provide a differentiated supply of oil and gas around the circumference of the casting piece. In particular regarding the supply of gas, it has been found expedient to supply the same quantity of gas around the entire circumference of the cavity at the start of the casting process. Subsequently, when the casting process has started and has become stable, the gas supplied to the upper area of the cavity is reduced.

Preferably, in this connection the annuli 20 for the supply of gas may be divided into two sectors, an upper sector and a lower sector, by means of restrictions (plugs) 21.

~~In particular regarding the supply of gas, it has been found expedient to supply the same quantity of gas around the entire circumference of the cavity at the start of the casting process. Subsequently, when the casting process has started and has become stable, the gas supply to the upper area of the cavity is reduced. Preferably, in this connection the annuli 20 for the supply of gas may be divided into two sectors, an upper and lower, by means of restrictions 21.~~

Moreover, regarding the primary cooling, i.e. the cooling provided through the rings 12, 13 in the cavity 17, it has been found expedient, in order to reduce the cooling, to make the ~~mould~~ mold housing 8 of steel instead of ~~aluminium~~ aluminum, which is the usual material. Furthermore, in order to reduce the cooling further, it may be necessary to shield (reduce the thermal transfer to) the cooling channel 14 by arranging an insulating annular plate 28, for example of ~~Plexiglas~~ PLEXIGLAS (polymetylmetacrylat), on the side of the housing part which faces the cooling channel.

The present invention as defined in the claims, is not restricted to the embodiments shown in the drawings and described above, thus, instead of using two independent rings ~~12,13~~ 12, 13 just one ring may be employed for the supply of oil and gas through the same ring.